

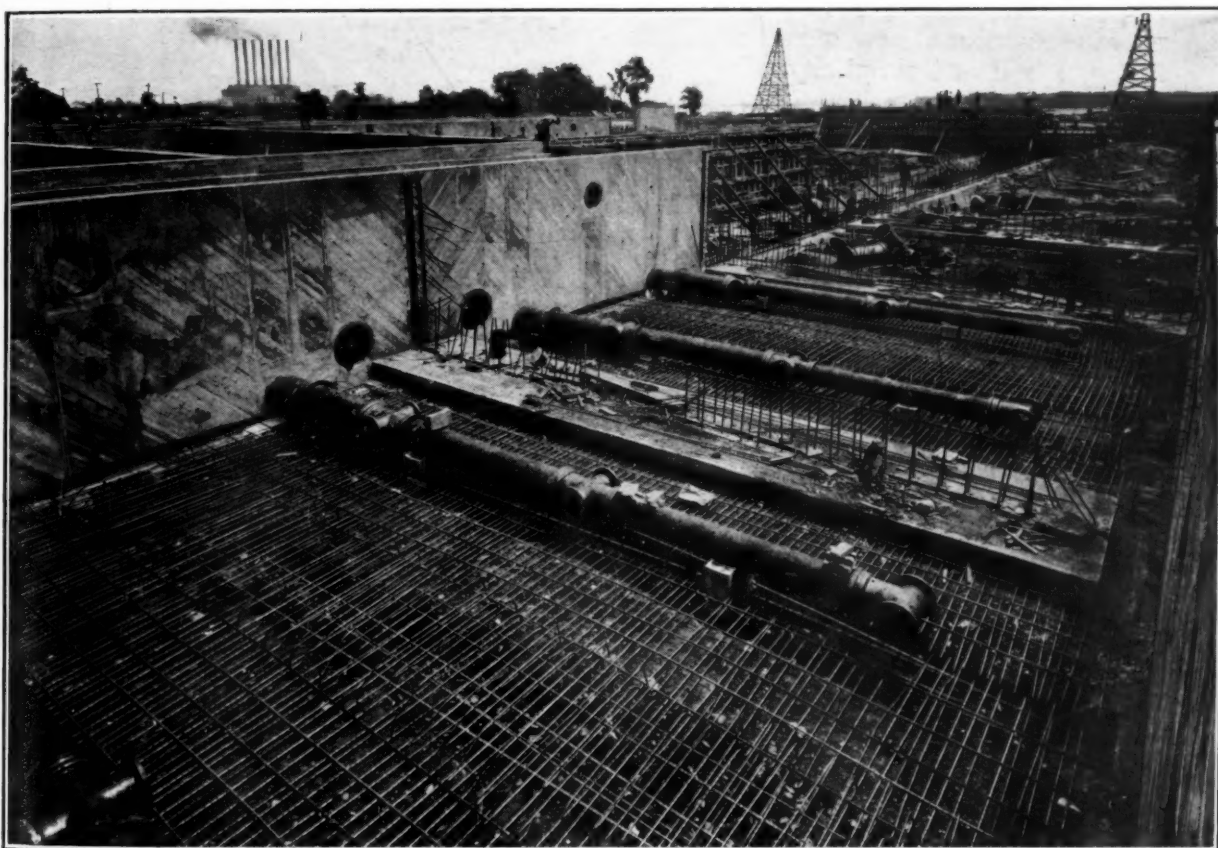
FEB 7 1922

# PUBLIC WORKS

CITY

COUNTY

STATE



CONSTRUCTING DETROIT FILTER PLANT. REINFORCEMENT AND PIPES LAID ON FILTER BED FLOOR, READY TO POUR CONCRETE.

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FEBRUARY 4, 1922

# KOEHRING

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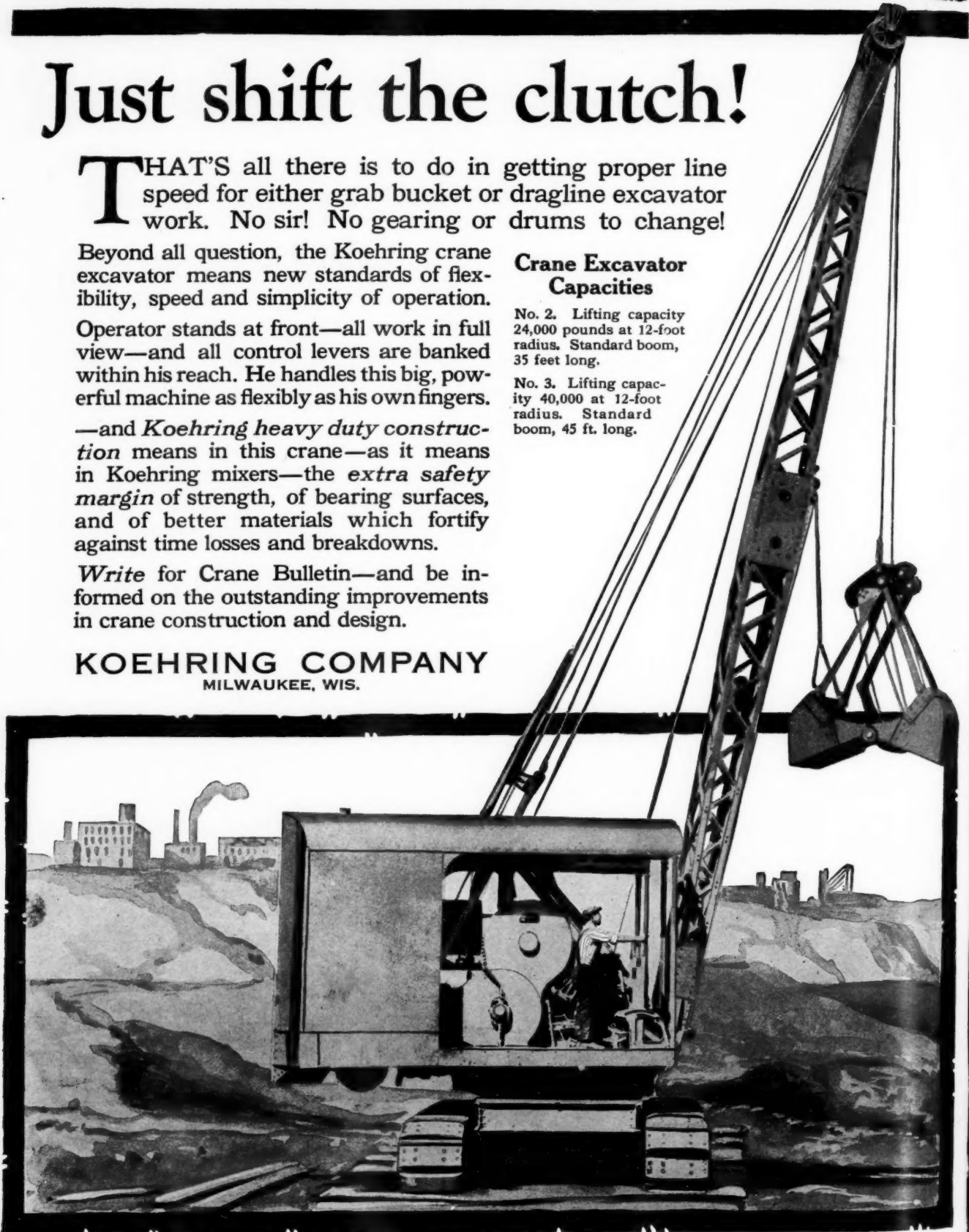
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# PUBLIC WORKS.

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A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 52

NEW YORK, FEBRUARY 4, 1922

No. 5

## Constructing Detroit Filter Plant

Equipment for handling and storing aggregate and mixing and placing about fifty thousand yards of concrete.

The municipal filter plant and coagulation basins for the city of Detroit has a concrete superstructure supported on about 15,000 Raymond concrete piles. It occupies an area of approximately 500x800 feet and contains about 48,300 cubic yards of concrete in walls, floor, and roof which are reinforced with about 2,200 tons of steel rods. About 9,500 yards of earth excavation was necessary. The contract for the superstructure was awarded to the Thompson-Starrett Co., which commenced operations last May and completed all of the work November 15th. During last summer they employed a maximum force of 300 men.

### RECEIVING AND STORING MATERIALS

There was required in all about 75,000 tons of sand and gravel, received in boats, unloaded by a Brown 35-ton locomotive crane and 1 1/4-yard clam-shell buckets, which deposited it in stock piles of about 500 yards capacity, whence it was reclaimed by the crane that delivered it as used to a 200-yard hopper-bottom elevated loading bin, from which it was chuted by gravity to the charging hoppers of two one-yard Smith mixers. The same crane also unloaded cement delivered in boats, which was stored in a shed of 30,000 bags capacity having hatchways

in the roof to receive cement skips. The locomotive crane was operated by one man and a fireman and had a capacity of 700 yards of material handled in eight hours.

There were required for the work about 300,000 bags of cement. In removing the cement from the shed, the bags were loaded by hand on skips, which were moved by jacklift trucks 50 feet to a platform elevator which delivered the skips to the charging floor of the concrete mixing tower where a similar truck transported the skips to the charging hopper.

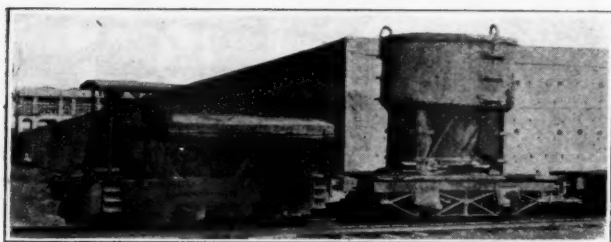
### MIXING AND DISTRIBUTING CONCRETE

The mixer was set about 20 feet above the surface of the ground and discharged into a 5-yard hopper with a bottom gate through which the contents were delivered to special 5-yard buckets on flat cars hauled by a Plymouth gasoline locomotive on an industrial track about 1,000 feet long, by which the buckets of concrete were delivered to trolley hoists on a pair of travelling cableways of 1,000 feet span which served the entire area of the work under construction and enabled the concrete to be deposited in the forms at any point at an average rate of about 100 yards per hour. The minimum time required to load, transfer,



PART OF CONCRETE FOUNDATION PILES DRIVEN, ONE SECTION OF WALL FORM SET AND TWO 1,000-FOOT CABLEWAYS INSTALLED AT FILTER BED





SPECIAL 5-YARD CONCRETE BUCKET HAULED BY GASOLINE LOCOMOTIVE

dump and return the 5-yard buckets was about 5 minutes.

#### SPECIAL CONCRETE BUCKETS

The 5-yard buckets were of special construction, about 5 feet in diameter and 8 feet high, with conical bottoms closed by horizontally moving steel gates and weighing about 4,000 pounds empty. They were suspended from the trolley hoists of the cableways by three-part bridles and were found very convenient and satisfactory in use, the slot openings in their conical bottoms enabling the concrete to be deposited with accuracy and rapidity in narrow forms.

#### CABLEWAYS

The two Lidgerwood cableways were suspended between timber towers about 110 feet in height and operated on seven parallel lines of rails at each end of the filter basin. Under each tower there were two standard gauge tracks 38 feet 8 inches apart on centers and a three-rail track 49 feet 6 inches from one of the standard tracks. Each set of tracks carried two head towers or two tail towers. The tail towers were traversed the full length of the 600-foot tracks by a 50 h.p. double drum stationary hoisting engine with an electric motor operated by 220 volt, three-phase, 60-cycle A. C. current. Each of the special drums operated an endless cable, which hauled one of the towers back or forth according to the direction at which the reversing drum was operated; each end of each cable operating an anchored tackle arranged as shown in the diagram plan. The head towers were similarly traversed by engines installed in the towers. The cableways were traversed at a speed of about 100 feet per minute and the buckets were hoisted and traveled on the cableway at a speed of about 1200 feet per minute by a 12x12-inch Lidgerwood cableway hoist operated by a steam engine and a 160 h.p. boiler installed in the base of the head tower.

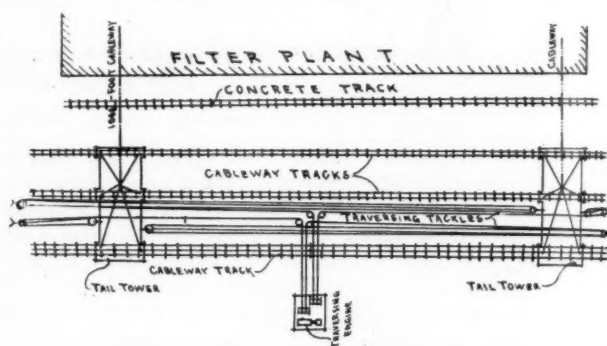
#### CONCRETING WALLS

The wall footings were generally from 12 to 20 feet wide and 6 feet thick. They were concreted in sections about 60 feet long, with the sides bevelled and recessed to engage the floor slabs and to form skew-backs for the floor inverts. The lower bent ends of the wall reinforcement rods were imbedded in the footings and projected several feet above the surface to bond with the wall concrete.

Wall concreting was carried on at six different places simultaneously, the walls being made in sections about 60 feet long cast in wooden forms made with heavy panels for each side. They were handled by the cableway hoists and were bolted together with horizontal through tie bolts bearing on three tiers of rangers. The end panels were similar to the side panels except that their dimensions were smaller.

The ground between the wall footings was trimmed and brought to smooth accurate surface at subgrade, the horizontal reinforcement bars were put in position carefully supported in the proper horizontal planes and wired together at occasional intersections. The cast iron collection pipes were assembled in position, supported on permanent concrete pillows and their lower portions were imbedded in concrete which was carefully rammed in position, screeded and troweled to the required upper surface. The flat roof was concreted in wooden forms supported by the division walls and by vertical shores with wedge adjustments.

The work was built under the direction of the Board of Water Commissioners of the city of Detroit, George H. Fenkell, general manager and Theodore A. Leisen, civil engineer.



TRAVELING TOWERS AT ONE END OF CABLEWAY

### Typhoid Fever in Detroit

It is reported by Dr. F. M. Meader, of the Detroit department of health, that a survey of 247 cases of typhoid fever which occurred in that city in June, July, August and September, 1921, showed that 43 cases, or 22.4 per cent apparently received their infection while bathing in the Detroit river. Some of the data which gave most probability to this conclusion were (1) the temperature of the air; (2) the presence of contaminated water and the location of these cases adjacent to this water; (3) the amount of bathing done in this water during the period when the patient was infected, and (4) the exclusion of other known sources of infection.

Bathing as a cause of typhoid fever has not often been considered an important feature or been included prominently in surveys made of typhoid epidemics, and this case is of special interest for this reason.

### Vanderbilt Village

A village was founded by the late George W. Vanderbilt on his estate near Asheville a number of years ago and was passed on to his heirs as a privately owned village. Less than two years ago it was purchased by a realty company. On January 1 of this year the city's commissioners, acting upon a petition from the citizens, purchased the water, sewerage and lighting systems serving the town from the development company. This town was laid out to be an ideal village, experts having been employed to plan it and design and construct its utilities.



## Amount of Street Sweepings in St. Louis

Amounts picked up by suction sweepers during five years. Amount removed just after a rain greater than from the same area at other times.

About five and a half years ago an arrangement was made for the sweeping of the streets of the shopping section of St. Louis by a suction sweeper by the Way-Cleanse Corporation, the area swept being about 176,000 square yards the first year and about 297,500 the last three years. Sweeping was done by night, the machines operating over the entire area every night except Sunday and stormy nights, the number of nights per year varying from 232 to 259.

The amount of dirt removed is measured and weighed and the records are probably more accurate statements of the amount of dirt removed than are those of most street cleaning departments. Moreover, it is believed that they more correctly represent the amount that collects on the pavements, for the suction sweeper is believed to collect the dirt more completely than does a broom, just as a vacuum cleaner obtains more dirt from a carpet than does a broom and dust-pan; while in the case of a street flusher a considerable part of the dirt is washed into the sewer.

The figures for the past five years have been furnished to us by the Way-Cleanse Corporation, and will be extremely interesting to municipal engineers. They are as follows:

Two sweepers swept the same section during the

year from Jan. 1 to Dec. 31, 1917, a total of 248 nights, 43,670,551 square yards; they picked up and hauled to the dump, 3,224,177 pounds of dirt and dust, or an average of 13,000 pounds per night, or 738 per great square.

Between Jan. 1 and Dec. 31, 1918, two sweepers swept the same section each night for 232 nights, 54,843,152 square yards; they picked up and hauled to the dump 3,448,300 pounds of dirt and dust, or an average of 14,863 pounds per night, or 629 per great square.

Between Jan. 1 to Dec. 31, 1919, two sweepers swept the same section each night for 259 nights, 77,077,749 square yards; they picked up and hauled to the dump 5,194,496 pounds of dirt and dust, or 20,056 pounds per night, or 674 per great square.

Between Jan. 1 to Dec. 31, 1920, two sweepers swept the same section 235 nights, 69,941,526 square yards; they picked up and hauled to the dump 4,982,904 pounds of dirt and dust, or 21,204 pounds per night, or 712 per great square.

Between Jan. 1 to Dec. 31, 1921, two sweepers swept the same section 233 nights, 59,658,606 square yards; they picked up and hauled to the dump 4,929,620 pounds of dirt and dust, or 21,157 pounds per night, or 826 per great square.

An examination of the above statement for five years of sweeping over the same section will show that the daily amount of accumulation per 1,000 square yards is almost constant.

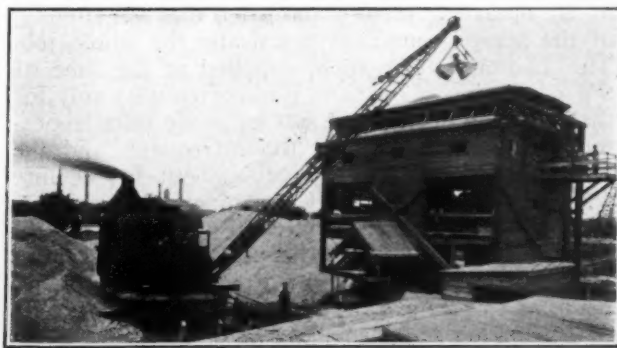
To determine the nature of the dirt that was picked up by the sweepers an analysis was made by the city chemist's department. The amount of sweepings used for the purpose was 5,256 pounds, which was placed in three kettles burning five hours at 800 degrees F. The loss was 26.60 per cent. of combustible matter. Of the remaining 3,858 pounds there was 60.20 per cent. passing a 200-mesh screen; 12 per cent. passing an 80-mesh screen; 1.20 per cent. passing a 40-mesh screen; 0.00 per cent. retained on a 10 mesh screen. Total, 100 per cent.

Another peculiar feature experienced was that after a heavy rain the machine sweeping the center of the pavement always picked up from one-half to one cubic yard more than was picked up from the same section the previous night or the night after. For instance, on June 23, 1916, it stopped raining at 4 P. M. The machine started to sweep at 8:15 P. M. The load picked up from 16,035 square yards was 3.92 cubic yards.

On June 24, 1916, sweeping the same 16,035



HEAD TOWER FOR NO. 1 CABLEWAY, DETROIT FILTER PLANT



TRANSFERRING SAND AND GRAVEL FROM STOCK PILE TO LOADING HOPPER

square yards, the load picked up was 2.18 cubic yards.

July 3, it stopped raining at 9 P. M. The machine started to sweep at 1:30 A. M. The load picked up from 16,035 square yards was 3.19 cubic yards.

July 4, 1916, sweeping the same 16,035 square yards the load picked up was 2.11 cubic yards.

July 19, 1916, there was a heavy rain from 1:30 to 3 P. M. The weather bureau reported .81 inches of rain. The machine started to sweep at 7:30 P. M., and the load picked up from 16,035 square yards was 3.18 cubic yards. July 18, 1916, sweeping the same 16,035 square yards, 2.78 cubic yards was picked up.

The center sweeper, as it is called, sweeps all but

nine feet on each side of the pavement. This is swept by the machine confined to sweeping the gutter.

We meet the same conditions in all cities where the sweepers have been demonstrated. Can any one who reads this account for this increase of dirt after a heavy rain?

### City Planning for Asheville

Asheville, N. C., is believed to be the first city in that state to adopt a full city planning method and is one of few cities in the South to do so. It has already taken steps towards a definite planning program, this including the appointment of a city planning commission and securing the services of an advisor on city planning.

## Operating Filtration Plants

**Too little attention is paid by most small cities to the maintenance and operation of their filter plants, in the opinion of Mr. Hinman, and he gives some excellent general advice as to plants requiring special attention by filter operators.**

In a paper before the Iowa Engineering Society entitled "Water Purification in Iowa," Jack J. Hinman, Jr., of the State University of Iowa, outlined comprehensively, but briefly, the condition throughout the state as to the kind and nature of the water purification plants, the character of the water in respect to necessity of purification, etc. Eleven of the plants use chlorination without other treatment, two are for iron removal, eighteen are filtration plants for removal of bacteria and turbidity, and two are coagulation and sedimentation plants for the same purpose.

Mr. Hinman calls attention to some of the defects in the construction and operation of the plants. A few he describes as being quite antiquated and inadequate, while others are apparently well designed and modern. "In a few cases there appears to be insufficient capacity of settling basins. Sometimes, as at Iowa City, a clear well is so small that the rate of filtration is subject to excessive variations throughout the day and night."

"In general, the greatest defect in the operation is the tendency to slight the filters, and devote extra attention to the pumping machinery. The opinion of the operating force is too often that the running of the pumps comprises practically the whole job. The laboratory equipment supplied at the time of the installation of the plant is too often used only for the collection of dust. Analyses at the state laboratories are in many cases too infrequent, and the plants are run for long periods without any definite knowledge as to how they are functioning or as to the quality of the effluent. Daily analyses are the rule at Cedar Rapids, Council Bluffs, Davenport, Iowa City and Oskaloosa. Frequent analyses are made at the state water laboratory on the supplies of Burlington and Keokuk. The occasional analyses made at the other plants vary from work of similar scope through simple alkalinity and turbidity de-

terminations to practically nothing. Des Moines makes daily tests upon the water of its chlorinated infiltration gallery supply.

"The variation in the effluents of plants which are carefully watched from day to day, is such as to indicate that unless there is some way of quickly spotting inadequacy of the treatment in use, so that suitable changes may be made, unsatisfactorily purified water may be supplied for long periods."

"Practically all of the plants have given one or more unsatisfactory results when examined at the water laboratory at the State University. In fact, only one plant has not been found to yield such a result when so examined, and that plant, which has supplied the state laboratory with few samples, is known to have furnished unsatisfactory results when examined locally by the health officer. It should be mentioned, in fairness to the operators of all the plants, that some of the samples were sent in to the laboratory at times when something was going badly at the plant, and there was fear as to the quality of the effluent. However, enough samples have been analysed to show that even a carefully watched plant may occasionally, especially under unusual or difficult conditions, yield an unsatisfactory water."

Mr. Hinman then gave some general advice as to the points which should be given special attention by the operator of a filtration plant, which we give in full herewith:

"In studying the character of a water supply there is no point which is more closely watched than the presence of gas-forming bacteria when the water is planted into lactose broth. The raw water which is treated in the plant is usually known to have suffered sewage pollution at some time in its history. These gas-forming organisms, certain ones of which are of value as indicating the presence of sewage-like material, give the analyst his chief clue as to the



adequacy of treatment and the safety of the supply. Bacterial counts show the relative efficiency of the removal of the organisms from all sources. The presence of the typical sewage organism, bacterium coli, in different quantities of water is largely depended upon to give the analyst an idea of the extent to which sewage and pathogenic bacteria have been removed.

"The bacterium coli, being a hardier organism than certain pathogens, such as the typhoid organism, may be presumed to survive after their deaths. The freer the water is, therefore, with respect to bacterium coli, the greater its safety. The bacterium aerogenes, closely related to the bacterium coli, is, like the latter, found in sewage. It is also associated with grain, and the soil, and other sources of a nature less objectionable than human sewage. This organism may survive after the removal of the colon type, but its presence in a filtered water is regarded as little less significant than that of its relative.

"There are also certain gas-forming bacteria found in soil, sewage, and elsewhere, which are especially resistant to treatment because of their ability to form spores. These spores can resist chlorine in all practical amounts, and can in some cases survive the boiling temperature for several minutes at least. Since these bacteria are so much more resistant than the pathogens which cause intestinal disorders, finding these spore-forming organisms in a water, particularly in the larger quantities tested, can not give us information of the same value as the presence of the bacterium coli in determining adequacy of treatment. We would, of course, prefer not to find the spore-formers, but whatever significance their presence has in a supply is limited to their own possible character as pathogens. Experience would indicate that in connection with water borne diseases, the possibility of their being able to produce intestinal infections is very remote.

"It has been our practice to class these spore-bearing gas-forming as a typical gas-forming bacteria. Usually the atypical forms, as distinguished from bacterium coli, and bacterium aerogenes, constitute the greater number of gas-forming organisms found in our filtered, chlorinated water in Iowa. Most of the atypical forms refuse to grow aerobically on the confirmatory plates. Any attempt, therefore, to judge the quality of the effluent of a filter plant by unconfirmed tests for gas-forming bacteria is likely to be unfair to the supply in question, although the error would be on the side of safety.

"In connection with the study of the gas-forming organisms in our filtered waters it is instructive to note the number of times that bacterium coli, bacterium aerogenes and atypical gas-forming bacteria were found in the water samples from plants listed in Table No. 3. A casting up of the numbers of tubes gives the following results:

Tubes showing bacterium coli.....	391
Tubes showing bacterium aerogenes.....	85
Tubes showing atypical gas-formers.....	1,902
Tubes showing no gas formation.....	8,188
Total number of tubes.....	10,566

"In this series there were about four atypical gas-

formers for each positive test for the bacterium coli or the bacterium aerogenes.

"In an attempt to learn something of the vitality of these atypical gas-formers, the writer took a culture of one of them, obtained from a water, together with a sample of raw water obtained from the same source. Ten cubic centimeters of the raw water and three or four cubic centimeters of the broth culture were added to separate tubes of lactose broth which had been heated to 80 degrees Centigrade. After planting, the tubes were maintained at that temperature for five minutes. The process was then repeated with fresh quantities of water and broth culture, holding the newly planted tubes at about 100 degrees Centigrade for five minutes. The tubes were then placed in an incubator at 37 degrees Centigrade and observed for gas production, as in the ordinary procedure in testing for the bacterium coli. The original culture was also submitted to the boiling temperature for five minutes and incubated in the same manner. The results of the test are indicated in Table No. 4:

Culture.	Table No. 4 Gas Formation.			
	24 hrs.	48 hrs.	72 hrs.	96 hrs.
Original culture.....	30%	70%	75%	75%
10 c. c. raw water, 80° C.....	0	10	30	70
do.....	0	10	30	70
3 or 4 c. c. original culture, 80° C.	8	8	8	10
10 c. c. raw water, 100° C.....	0	60	80	80
do.....	0	Trace	10	20
3 or 4 c. c. original culture, 100° C.....	10	10	20	30

"From such a showing as this, one is justified in saying that these particular organisms are very resistant, at least as far as heat is concerned. They also showed great resistance to chlorine. A relatively high chlorine dosage had comparatively little effect on them in the water supply. Alum dosage seemed to offer the best possibilities, but it is doubtful, however, whether the comparatively large amount of alum necessary to effect their removal is a justified expenditure. If it were true that these forms were known pathogens, their removal would become necessary, but if they are merely to give us data as to the removal of sewerage matters, we have a better indicator in the bacterium coli.

### Minnesota Roads Turnpiked for \$150 Per Mile

In a testimonial to a gasoline or kerosene tractor manufacturer, D. R. Savage, district engineer, Windom, Minn., writes in part:

When we first began to build roads in Cottonwood County with a tractor and blade grader we thought that one day would make a mile of road, but our standards have changed and now we put four days and sometimes more on a mile.

We begin by staking out a road with two rows of stakes, 40 feet apart, generally putting a pair of stakes at every second telephone pole. We cut down 18 inches deep into the middle. This will make a crown of about a foot of dirt in the middle of the road which will make a raise of 30 inches from the bottom of the ditch to the top of the crown. Two rounds carries the dirt from the ditch to the center generally, as we use two 12-foot blades. We con-



sider that the packing effect of the engine is fully as valuable as the moving of the dirt.

We generally, in making the first cut of sod, make a wide shallow furrow in preference to the narrow and deep furrow, as this splits up the sod more and then after it has been rolled over and pressed down with the engine, we give it another scrape in moving it over to the center and all this tends to obliterate the sod. Sod is no problem, as we can use it and crush and cut it up. It only means a little more work.

A great deal of our work might be termed "finishing," as all the time we are smoothing out and working the dirt back and forth. The last touch is to run the blades out and cut off the top of the crown and push it out to the shoulder, leaving a twenty-four foot roadway with about a foot crown to it.

When we first began to build roads, we were satisfied with a smaller ditch and poorer finish, but

experience has shown us that the road might as well be built right in the first place and be done with it, as otherwise it will have to be reshaped in a few years.

We finish about twenty miles in a year, and besides do a lot of temporary work and reshaping of roads that demand immediate attention.

Last year we put six weeks into maintenance work, which meant making one to three rounds over all in the county designed as state road, which we had to care for and which was not yet constructed.

In these roads the top of the road had become concave, instead of convex, and there was nothing for the road drags to work on, so we knocked off the shoulders and then drew some fresh dirt up into the middle of the road, so that the road drags would have something to work on.

The cost of the turnpiking and finishing a road is generally about 3 cents per foot, or \$150 per mile.

## Road Convention Papers

Excerpts from papers read at the Chicago Convention of the American Road Builders' Association at Chicago, January 17 to 20. Owing to space restrictions none of the papers can be given in full, but only those parts are selected that seem in our judgment to convey the ideas of greatest importance or interest.

### The Highway Outlook

By Thos. H. MacDonald,  
Chief, U. S. Bureau of Public Roads

There is the universal demand for economy which must be met. There is the insistent demand for the lowering of taxes which must be heeded. These same facts apply to local, State and Federal expenditures and taxes. On the other hand, there is

The unemployment situation,

The competitive period ahead,

The demand and necessity for internal improvements.

The situation demands wisdom, foresight, leadership of the highest character. Wise expenditure is more necessary than uneconomical saving. Thus the highway outlook is not determined by any narrow or limited consideration but by all the broad social and economic relationships with which the highways have intimate contact.

We need to establish a highway balance sheet, national in extent, on which we set up,

On one side, 1, the funds available; 2, the economic situation; 3, prices and costs for highway improvements.

On the other side, 1, the deferred highways improvements; 2, the returns from highway investments; 3, the need of universal easy and cheap transportation facilities.

Year	Funds Available	Total expenditures, approx.
1904	.....	59,527,000
1914	.....	240,263,000
1917	.....	279,915,000
1918	.....	286,101,000

1919	.....	389,455,000
1920	.....	500,000,000
1921	.....	600,000,000
1922	.....	720,000,000*

*Sources of revenues.* On the basis of the estimated total highway expenditures for the year 1921, the sources of this fund are approximately as follows:

Motor vehicle revenues.....	19%
State road bonds.....	7
Local road bonds.....	33
State taxes and appropriations.....	12
Federal aid.....	14
County, township, dist. taxes and Ass.....	14
	100

It would be unfair to say that the unprecedented depression in which we find agriculture today is due wholly to the very large increases in freight rates which have been imposed during the past years, but it is fair to say that these increased freight charges are a large factor in retarding agricultural recovery.

\* \* \*

The purchasing power of the major farm crops, is probably lower than at any time in our history and this has very much to do with the nation-wide industrial and business depression. The conclusions are self-evident.

1. During the period 1910-1921, the potential number of motor vehicles demanding highway service increased more than 1800 per cent. Our actual expenditures for construction and maintenance increased about 400 per cent.

\*Is the estimated sum which has been made available but subject to conditions and limitations that will materially reduce the total which is actually expended.

2. During the period 1910-1914, motor vehicles increased more than 100 per cent, highway expenditures about 140 per cent.

3. During the period 1914-1921, motor vehicles increased about 700 per cent. and highway expenditures about 200 per cent. of the 1910 figures.

But even these figures do not truly represent the differential between the demands for highway service and our actual production.

## Cost Keeping on Highway Construction

By A. R. Losh,

Assistant Chief of Construction, U. S. Bureau of Public Roads

Of recent years, due to a scarcity of contractors in the highway field, it has been necessary for States and counties to do a large amount of highway work with day labor forces and the value of cost keeping as a check on expenditures and as a guide to efficient management has led to the installation of cost keeping of some kind on this work. In addition to serving these ends many valuable cost data have been accumulated which form an important part of the fiscal records of the work and have also been used advantageously in placing other work under contract. With one State highway department cost keeping on contract work is incidental to the inspection and the resident engineer or inspector is to considerable extent left to his own devices in this regard, while with another State highway department the cost keeping is one of the important functions of the residency and not considered a sideline by any means.

When the cost on contract work is considered advantageously the method followed is either to select the jobs which will supply the information desired or to cover the entire program and keep costs on all contracts. In either case there should be sufficient force available to handle the inspection and cost keeping properly. It will be difficult if not impossible to secure satisfactory results unless the inspectors or cost keepers receive specific instruction as to what they are to do, are supplied with standard recording and report forms, and their cost keeping supervised as well as their inspection work. \* \* \*

The advantages resulting from keeping costs on contract work are usually given as follows:

1. Valuable cost data are secured which may be used for estimating purposes.
2. The department has available necessary cost data for making settlement with contractor where unforeseen conditions are involved.
3. Engineers and inspectors receive training in use of cost data and making up of estimates.
4. Provides a means for analyzing cost of work which may lead to development of more economical designs and methods.
5. In some cases of assistance to the contractor who may not have an adequate cost system.

The Bureau of Public Roads has abandoned the practice of keeping costs on all of its contract jobs but is instead keeping costs on all day work and on such contracts, where it is though the data will be advantageous to the Bureau. It will prove advantageous to a State highway department to collect cost data on a number of representative contracts each year as a general check on the cost of its designs and also to determine the margin of profit contractors are getting.

The increasing use of cost keeping by contractors is even more pronounced than in the case of the State and county organizations. \* \* \* Highway contractors are now working individually and through their organizations for more systematic and business-like methods in estimating work and in the keeping of construction costs. \* \* \* The present tendency is for highway contractors to develop cost keeping systems comparable with those in use by the building industry. \* \* \*

For a contractor's use, the cost system should furnish reliable data on current costs. \* \* \* Next in the importance to the contractor is the value of cost data as a guide for estimating future work. The increasing complexity of highway construction is making cost keeping of more importance. The large sums of money now involved in road contracts mean more items of work, new processes, and additional operations over former requirements. To estimate the cost involved without comparable cost data is becoming too costly a hazard. It is not enough to know that there was a net profit on the job, but in order to use the data for estimating purposes it must be known by items and operations the actual cost of production. \* \* \* Cost data on new or unusual methods of construction and on the use of various plant units are of particular value as similar conditions are likely to be encountered in the future and a basis for cost estimates is available.

It is believed that the proper basis for a cost system is the four principal elements of cost allocated to the units of production.

- (a) Labor costs.
- (b) Material costs.
- (c) Equipment costs.
- (d) Administration costs or general expenses.

The products or highway construction to which these cost elements are assignable are road parts. Fundamentally these parts are:

- (a) The right of way.
- (b) The roadside, shoulders and grade.
- (c) The traveled way or roadway proper.
- (d) Drainage channels or ditches and drains.
- (e) Drainage structures or bridges and culverts.
- (f) Supplementary structures of miscellaneous road parts, such as guard rails, retaining walls, guide posts, etc.

Thus, there are six major products on each of which there may be four elements of expense or cost; consequently, we have 24 cost divisions. Since general expense is not ordinarily ascertained directly on production but is pro rated to the various operations the actual cost divisions with which the cost keeper is directly concerned are reduced to 18. It is believed that this is the minimum number of cost divisions which will provide a satisfactory highway cost keeping system.

These cost divisions are susceptible of much further analysis by breaking them up into various operations. For example, a square yard of concrete roadway is one of the unit products. The cost divisions for this are three, i. e., labor, materials, and equipment. To these three may be added the pro rated general expense. For further analysis, this square yard of roadway may be subdivided into subgrade finishing, placing of forms, hauling materials, mixing concrete, placing concrete, curing concrete, etc. \* \* \*

In placing the cost items against the appropriate construction items the greatest difficulty appears to



be in correcting with equipment costs and "administration costs." It is the experience of the Bureau of Public Roads on its own work that these items are given less attention in the preparation of estimates and in the segregation of cost to construction items than the more nearly definite items of "labor" and "materials."

The handling of equipment costs has been greatly simplified by the use of a rental factor computed to cover fixed charges, depreciation, overhauling, lost time, storage, and supervision. In the case of its own plant the Bureau has prepared rental schedules for all units of equipment having a useful life of more than one working season and costing more than twenty-five dollars. Small tools and those which are usually worn out on one job are handled the same as materials. This plan has been in operation three years and except for a change from a monthly to a daily basis it is practically the same as originally developed. It has proven satisfactory on both day labor and contract work of the Bureau. A rental factor of this kind is necessary where current costs are determined for purposes of management. \* \* \*

As general expense is not usually assignable directly to units of construction and many of the expenditures do not come to the attention of the cost keeper on the job there is a tendency to overlook this element until the project nears completion, at which time the cost is pro rated to the work completed. The result is a sudden jump in unit costs. Even with this apparent defect this may prove the best method to adopt as it greatly simplifies the handling of general expense items. Where limited funds require careful attention to gross expenditure on a project this method is not recommended. Occasionally it is found that the general expense is quite high in starting a job and if this is pro rated to the small accomplishment during the first few weeks of the work there are shown abnormally high unit costs which are not a true indication of conditions.

Two suggestions are offered for the handling of general expense. First, it will be found advantageous to divide general expense into two parts, one of which includes those costs which are assignable directly to the project and the other the general administration costs of the organization which must be pro rated to all its various projects. This latter part need not be considered in current cost reports as it does not in any way affect the efficiency of the construction organization on the project. This part of the general expense may be apportioned to the project upon its completion.

The second suggestion is that the amount of general expense (project) taken up and pro rated on current reports be a percentage of the total probable general expense, which percentage to be not greater than the percentage of the project completed. For example, if the project is only 10 per cent. complete, pro rate to completed work not more than 10 per cent. of the total probable general expense. On projects where the cost of "moving in," "camp installation," "organizing" and "disorganizing" is of a considerable amount the unit construction costs are liable to be materially affected if this entire cost is distributed before the work is well under way.

\* \* \*

Insofar as field procedure is concerned simplicity

is a very important consideration and it should be such that the required data can be successfully compiled by foreman and timekeepers. The effectiveness of the system will depend to a great extent on the celerity with which the unit costs may be ascertained. Unless the cost of doing the work can be determined easily and promptly its value as an aid to efficient management is lost. Some consideration should be given to making the cost system adaptable to the general work of the organization and not design it entirely for an individual job or set of conditions. \* \* \*

A great step forward would be accomplished by a general classification of cost keeping terms. Many of these as now used are subject to several interpretations. Engineers and accountants could materially improve the situation by reaching a common understanding in this regard. \* \* \*

### Highway Economics

By W. K. Hatt, Director, Advisory Board on Highway Research, National Research Council, Washington, D. C.

The proportion of the National wealth available for the purposes of transportation is limited. This proportion must be distributed among the various agencies, railroads, highways, etc. Inasmuch as the money spent on one agency is not available for another, it is clear that highway transport is intimately bound up with transportation in general. At present we see but dimly this new form of transportation, highway transport which has come upon us in the past fifteen years. No men can think wisely, and no legislation can be properly based, until the data of economics of highway transport are assembled and analyzed.

That part of the national wealth devoted to highways should represent capital invested, earning dividends, and not capital consumed. Therefore, the location and type of road, should be based upon the traffic, present and future, the climatic conditions, the foundation and available materials. In other words, the economic balance between capital cost and operating expense should be maintained. The highway should be designed, as an engineer designs anything else, to fit the conditions.

But when we speak of operating costs, where are the data? Who knows the maintenance costs of various types, properly allocated to surface, shoulders, ditches, etc., and the replacement cost; and the traffic that reflects itself in these costs? And who knows the operating costs of the vehicle arising from roads of various grades, lengths and surface? Since somewhere near 12 dollars are spent on the vehicle where one dollar is spent on the road, the survey of the situation should not be confined to the road.

And who should pay the cost of highways, the user alone, or property and user? What part of the cost should be met by bonds and what part by current funds?

Now it is clear that highway development in the future must depend upon a more critical economic analysis than in the past; and the highway transport officials must prepare their case. The data of economics of transport must be gathered as rapidly as possible.

On the engineering side we have made rapid progress, studying materials, strength of road slabs to



carry loads over various conditions of sub-grade. So that when the legislators tell the engineer what maximum load he is to provide for, a fairly consistent design will be forthcoming. But will the legislator decide this question, arbitrarily?

The Advisory Board on Highway Research, of the National Research Council, has its sleeves rolled up, and is on the job. Its job is to draw up a comprehensive program of highway research, to make use of the research agencies in this field of research, and to collect and distribute the information that will allow a wise judgment upon these questions.

## Bituminous Foundations for Street and Road Pavements

By Hugh W. Skidmore,  
Of the Chicago Paving Laboratory, Inc.

The two most important elements affecting the design of pavements for both city streets and county roads are the character and the intensity of the traffic to be carried. These two factors combine to determine the probable destructiveness of the most potent of all traffic forces—impact. There are other important considerations, such as bearing power of soil, temperature variations, drainage, quality and quantity of local materials, etc., but all of these are of secondary consideration when compared with traffic. The remarkable changes in kind, weight and speed of vehicles which have occurred in the last few years, have necessitated departures not only from some of the accepted practice formulae pertaining to various pavement types; but also from some of the previously conceded standard types of foundation and wearing surface construction.

It is ridiculous to assume that any one type of foundation or wearing surface will prove the best under all conditions. In fact, it is often times the case that more than one basic design should be used within a given length of pavement. \* \* \*

Two schools of thought, as applied to pavement foundations, have been evolved. These are essentially different in their fundamental principles. One of them seeks to overcome the destructive effect of the traffic loading, which at any instant may be converted into impact of variable intensity and often equivalent to several times the dead load, by means of a rigid slab possessing strength superior to the possible force of impact; the other dissipating the blow by absorbing a very considerable portion thereof through a flexible structure, which is always in actual contact with the sub-grade, thereby insuring greater uniformity of load distribution and functioning as a distributing medium or foundation and not as a deflector.

### RIGID TYPES

Rigid types, since they must possess strength superior to the traffic forces, have undergone in rapid succession modifications, which, with few exceptions, have been of such nature as to increase the original cost of the pavement very substantially. Perhaps the most important reason underlying the necessity of these modifications is the fact that the rigid slab is not at all times in actual contact with the sub-grade, and, therefore, does not always function as

a distributing medium, but must sustain the entire force of the loading within itself. The fact that concrete pavements warp due to temperature stresses indicates that at almost any time the rigid slab can be expected to be functioning either as an arch, with bearing at the outside edges of the slab and free from the sub-grade in the central portion—or functioning as a simple cantilever beam, with the fulcrum at or near the crown, and with the outside edges not in contact with the sub-grade; therefore, the maximum strength of the rigid pavement slab will be demanded when it is acting as a cantilever beam. The internal stresses in pavements, created by changes in temperature, often times become very powerful forces and to date the rigid type of construction has failed to offer uniformly satisfactory resistance, as evidenced by cracking.

While it is true that the seriousness of such failures is often reduced by more careful attention to drainage, preparation of sub-grade, etc., they are, nevertheless, admittedly inherent weaknesses in this particular type. Soil conditions in certain sections of the country may be such that during a portion of the year the bearing power of the soil will be so low that it cannot be relied upon as offering any very substantial support to the pavement structure. The unstable soil condition may be of limited extent and the soil may be of such character as to admit of ready drainage so that proper attention to this feature will remove the difficulty. Again, unstable soil during a considerable portion of the year may prevail more or less generally throughout certain localities, or the soil may be of such nature that it is practically impossible to adequately drain it even with very elaborate structures. In such cases the construction of sub-foundations may prove a practical solution, while at other times it will be found that a rigid pavement structure will be the most economical. Likewise often times a combination of sub-grade drainage and the construction of artificial sub-grade or sub-foundation overlaid by either a rigid or a flexible type of structure will prove to be the most adequate solution. \* \* \*

### FLEXIBLE TYPES

Flexible and semi-flexible pavement structures are the oldest types known, and we have only to picture the old Roman roads to realize that the soundness of such construction was thoroughly demonstrated long ago. \* \* \*

Flexible foundations include gravel, broken stone, waterbound macadam, bituminous macadam, and hot-mix bituminous concrete. They are usually classified as to value in a pavement structure in reverse of the order named with bituminous concrete as the highest type. It is estimated that there are 15,000,000 square yards of "black base" giving satisfactory service in this country.

The bituminous foundation structure, although possessing considerable beam strength, functions primarily as a shock reducer, that is, it gives slightly under the blow of impact in transmitting the load to the subgrade. Therefore, the design of this type places considerable reliance in the load supporting power of the subgrade. Its use then is dependent upon a knowledge of the ability of the subgrade to support loads equal to the probable force of impact reduced by the slab strength residing in the bitum-

inous structure; whereas the rigid type, regardless of the bearing power of the soil, must be built to sustain the entire force of impact. For this reason a much thicker rigid foundation is required under given traffic and subgrade conditions, as has been demonstrated by impact tests.

It will be readily seen that even where soils are of questionable value as a subgrade, bituminous foundations may still be employed economically, if an artificial subgrade of broken stone, gravel, boulders, or even cheaper materials, is first constructed. When old macadam or gravel roads already exist, an excellent artificial subgrade is offered at almost negligible cost. If widening is necessary this can usually be accomplished as in the case of the Kingston Pike at Knoxville, Tenn., where "black base" was laid about four inches thick over the old macadam and 7 inches thick at the edges of the widened pavement.

In the West, where the most extensive yardage of bituminous foundation has been laid, the general practice seems to be in taking alternate bids to specify 5 inches total depth for "black base" pavement and 7 inches for Portland cement concrete pavement of 1-2-3 mix. And the general opinion appears to be that the "black base" type is giving superior service. Almost universally bids for "black base" pavements have been less than for either Portland cement concrete pavement or asphalt wearing surface on Portland cement concrete base. The saving has varied from 20 to 60 cents per square yard.

#### CONTRACTORS' VIEWS

Questionnaires were sent to well-known concerns throughout the country. Both the number of replies, covering every state and parts of Canada, and valuable data contained in them, greatly exceeded expectations. \* \* \*

The experience of contractors is such that they are willing to guarantee "black base" as readily as Portland cement concrete, and with few exceptions, stated that less risk was attached to "black base." The experience of contractors generally has been decidedly lower maintenance expense, and lower first cost except in a very few instances where freight rates proved to be an extraordinary item. Assuming equal depth of foundation, the use of same aggregate materials in both types, and Portland cement concrete not to exceed 1 3-5 in richness of mixture, 90 percent estimated a difference in initial cost of from nothing to 50 cents per square yard less for "black base" and 75 per cent estimated "black base" at from 25 to 50 cents per square yard less than Portland cement concrete. Since it is true that under similar traffic and subgrade conditions, less depth of "black base" is required, it will be readily seen that rigid foundations will usually cost substantially more than the highest type of flexible base.

One contractor said that during the past 14 years, 85 per cent of the pavements he has laid have been upon flexible foundations, including broken stone, macadam and a goodly yardage of "black base."

\* \* \* The only objection raised to "black base" construction by any of the contractors was the possibility of idle equipment in the event a protracted rainy season was encountered on work where the subgrade did not drain readily.

A Southern contractor's reply seems to typify the attitude indicated by all of them—"Our opinion is

that engineers will be performing a useful service in securing the adoption of specifications for black base as an alternate to the use of concrete base."

#### ADVANTAGES OF BITUMINOUS CONCRETE FOUNDATION

1. Because of greater resistance to impact, permits the use of a thinner base course than is required of the rigid types.
2. Provides uniform contact with the subgrade, thus insuring greater uniformity of local distribution, and precluding the necessity of relying upon the pavement structure to sustain the entire force of the traffic loading.
3. Provides homogeneity of mass and positive bond between wearing course and foundation when bituminous top course is employed.
4. Provides freedom from cracks, upheavals, and ruptures which are common to rigid types.
5. Insures against the presence of moisture in the foundation structure, thus prolonging the life of the pavement.
6. Does away with the long period of time required for the curing of Portland cement concrete, thus permitting the opening of completed work to traffic immediately and providing a greater rapidity of turnover to the contractor.
7. Permits the use of the same aggregate materials as are ordinarily employed in Portland cement concrete, foundations, and provides decided construction economies.
8. Under given conditions costs substantially less than rigid construction.
9. Maintenance expense is less than for rigid pavements.
10. May be easily repaired at minimum cost, the surface patch method being applicable except in the case of serious defects.

#### Politics Eliminated from Ontario Highways

Addressing the past presidents and directors of the American Road Builders' Association, the Hon. F. C. Briggs, Minister of Public Works for the Province of Ontario, Canada, declared that road building in his territory is divorced entirely from politics.

"We have 57,000 miles of road all told in Ontario," said Minister Briggs. "We propose to spend \$25,000,000 on new roads this year. We have 2,000 miles of improved roads now under maintenance. The Dominion Government pays 40% of the maintenance; the Province of Ontario 40% and the municipalities 20%. In municipalities of less than 750 population, our roads are built through the municipality without cost to the town. If the town is above 750 in population the Province pays 40% of the central 20-foot width.

"Politics is not known in road construction in Ontario. We have no commission to blame for anything. The Minister of Public Works is responsible to the people from the floor of parliament. Our people are not favorable to commissions. If the Minister of Public Works does not make good, he finds after the next election that somebody else has his job.

"All of the bridge construction in Ontario of whatever nature, whether the bridge be 10 feet long or 1,000 feet long, is done by my department. We have a staff of 65 engineers, all of whom are directly responsible to the head of the department. Of this staff 97% served with the Canadian forces in Flanders or France. We are rather proud of our part in that."



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### Imhoff Tanks and the New Jersey Health Department

We have received the following letter from the author of the articles on the Imhoff tank which began in the January 21st issue and will be concluded next week.

Editor of Public Works,  
New York City.

Dear Sir:

I note in the publication of my article on "Sewage Treatment in Imhoff Tanks" in the January 21st number of PUBLIC WORKS that in one or two places you refer to the conclusions therein as being those of the State Department of Health of New Jersey. This is especially apparent in the subtitle and in the editorial.

While much of the material was secured from personal observation and inspection in the course of my duties as assistant sanitary engineer for the Department, the views and opinions expressed are strictly my own and in no sense those of the Department.

It is therefore requested that you correct at the earliest possible date the impression given by the sub-title and editorial as published.

Very truly yours,  
Russell Riker.

We hasten to give this letter as early and prominent publicity as possible, and to express our regret that we should have given any occasion for it. We must plead guilty to giving in the sub-title the impression referred to by Mr. Riker, but in the editorial we were particular to state that the opinions given in the article were "the views of the writer" and "the ideas of Mr. Riker personally," and "not officially given out as" those of the department, although we supposed that they might be considered as such.

We hope that this explanation will reach the eyes of all who may have seen the article, and correct any impression they may have received as to the department sharing Mr. Riker's views on the subject.

### Equating a Great Engineering Project

With lavish use of time, labor, capital, materials, and equipment, almost any engineering or construction problem plausible enough to receive serious attention may be executed so as to function fairly well. It by no means follows that such an accomplishment is necessarily entitled to be considered a success. If success is to be properly assured, the work must measure up to various standards of safety, durability, economy, efficiency, value, and in many cases to commercial justification.

With unlimited expenditure of time, money and often of human life it is now possible by the aid of artificial power, mechanical equipment and scientific developments to accomplish construction operations, involving enormous dangers and difficulties. But unless such are vital to the public safety they should not ordinarily be undertaken until it is clearly demonstrated that the reasonably certain results will fully justify the various items of direct and indirect cost and show an unquestioned balance in favor of public welfare, development or commercial profit.

Since the beginning of the last war the orgy of expenditures in life and public resources have been so great that the sense of proportion and value of the ordinary citizen is largely dulled, and because they may be scientifically or mechanically within the range of possibility, stupendous engineering schemes are seriously discussed when there is little chance that they would be justified by any reasonable consideration of probable results.

Within the limits of private or corporate investments, the test of profit or earnings goes far to restrain these projects, although it does not always prevent their manipulation by unscrupulous or incompetent men anxious to handle large sums of money for what can be made in the process, without regard to ultimate conditions and results. For very large enterprises that require government finances the danger is much greater on account of the ease with which government funds are recklessly diverted by astute politicians or financiers with little regard to sound business principles.

It may be quite possible to double the maximum existing bridge span at five or ten times the expense of the most costly similar structure in the world: to dam the Niagara river for the development of a not yet necessary huge water power; to turn the finest roadstead and most beautiful harbor in



the world into an artificial peninsula; or to build rival tunnels where all resources should be concentrated upon one. All these things may indeed be accomplished by the expenditure of hundreds of thousands or millions of dollars commandeered from staggering taxpayers, but such enterprises should not be lightly undertaken or undertaken at all until their cost can be kept well within their conservatively capitalized values.

Considerable effort has been made to force the United States into the joint construction of the St. Lawrence ship canal through foreign territory. The idea of making an ocean route to the northern and central states and Mississippi basin is appealing, but it should not be exploited until, following deliberate investigations, the highest commercial, financial and engineering authorities have approved of it. The statement of the chief engineer of New York State and others, which is summarized on another page of this issue, indicates that the cost would be tremendously greater than the estimate submitted by the promoters; that the capacity would be much impaired and the cost of transportation increased by the different ocean and lake conditions encountered; that the canal could be only intermittently used; that it is not the only nor the most suitable ocean pathway to our inland states; and that its operation would actually injure the splendid equivalent waterway within our own boundaries on which \$200,000,000 has been expended and which is not yet utilized to anywhere near its potential capacity. These facts should give pause to even the most ardent proponents for American construction for an alien ship canal.

### Locomotive Turntable for Graveling Highways

The construction of 8½ miles of gravel road No. 5 in Cherokee County, Iowa, was facilitated by the use of a special dumping appliance devised, constructed and operated by Roorda Bros., contractors.

The device consists of a power operated locomotive turntable built partly with a Ford engine radiator and truck wheels, that travels along the highway and provides for the quick and accurate dumping of loads of gravel irrespective of soft or rough surface, secures even distribution of the gravel, facilitates its spreading and the turning and dumping of the trucks.

The power driven turntable is installed two or three feet above the surface of the road on a long I-beam platform, at the front end of which two riveted stringers or plate girders are attached to the floor at one end and rest on the ground at the other end, forming skids up which the Ford trucks loaded with gravel ascend to the platform and mount the turntable. The latter, revolved by power, turns the truck completely around, after which it is dumped and descends into the roadway again, completing the whole operation rapidly and with much more accuracy and convenience than by the ordinary methods.

A sliding rod on the platform scratch-marks the center of the dumped load, and after it has been

dumped the platform advances until an index on it coincides with the scratch mark and it is stopped to receive the next load and so on. The truck is loaded with an equal amount of gravel for each trip to insure a perfectly uniform distribution by means of this inexpensive home-made device, which is operated by one man.

The gravel trucks have Ford chassis with a special body, designed by the contractor. They are heavily loaded and are expeditiously hauled out of the gravel pits by a Fordson tractor with a long cable.

### Objections to St. Lawrence Ship Canal

The proposal to canalize the St. Lawrence river and build new structures in Canadian territory to provide another shipway from the Atlantic Ocean to the Great Lakes by the joint effort of the Dominion of Canada and the United States is discredited by the investigation of Frank M. Williams, state engineer of New York, and others. It calls attention to highly unfavorable physical conditions, the very dangerous and often fatal fog zone at the eastern terminus that causes the refusal of all naval insurance there after November, and the severity of the winters that closes the route for about one half of every year. The transformation of the highly economical and efficient lake carriers to make them suitable for canal and ocean service would retard their speed and very greatly increase their operating cost. According to their revised estimate, the International Joint Commission's estimate of \$252,000,000 for the cost of the project is far too low. With the completion of the work by the development of the full 4,000,000 h.p. claimed, the cost will be \$1,300,000,000 plus an unknown, but heavy, property damage.

The United States will gain nothing in power rights, which it already possesses in the river much beyond the 1,000,000 h.p. which might be allotted to it, because the power rights already belonging to the State of New York would be turned over to the joint American-Canadian Commission and the State of New York would in addition to this great loss of potential energy compelled to pay 28 per cent of the Federal outlay on the canal.

Furthermore, Mr. Williams claims that the canal is neither necessary nor best, but that the Erie canal, the Barge canal and the Hudson river already furnish a magnificent connection between the Great Lakes and the Atlantic, serving exactly the same territory that the International canal would serve and representing around \$200,000,000 of work that has already been expended on them and a construction that is not utilized to anything like its present capacity and is capable of great enlargement at a price far within the construction of the St. Lawrence canal and which would tend wholly to the prosperity of this country rather than to aid in the competition of a foreign country. The claim that the St. Lawrence ship canal would save 10 cents per bushel on grain freights to Liverpool seems to be refuted by the statement, made from detail records, that the normal total cost of shipment from Duluth to Liverpool via Erie canal is only 10.73 cents per bushel.

# Sewage Treatment in Imhoff Tanks\*

By Russell Riker

**Experience of a number of plants with foaming in the gas vents. Operating data of New Jersey tanks.**

Most of the operating trouble with Imhoff tanks in this state is due to scum formation in the gas vents. At Washington, Princeton, Westfield and Plainfield the scum collects to such a depth as to cause solids to rise up through the slots. The operators could not keep down the heavy scum and were able to deliver a satisfactory effluent only by daily removal of the floating material on the surface of the settling chamber. Within the past year foam has overflowed the gas vents at Plainfield, Pitman and Oaklyn. The accompanying photographs illustrate the condition at Plainfield and Oaklyn.†

Many of the operators endeavored to remove the scum from the gas vents but at many of the plants this procedure is very difficult. At Plainfield two men were kept busy removing scum. At Pitman the operator reported that over 100 wheelbarrow loads of floating sludge and scum were taken from the gas vents in an interval of one month. At present more attention is given to removing the scum from the surface of the settling chamber, and the scum in the gas vent only agitated enough to allow the gas which is continually arising from the decomposing sludge to escape.

At some plants it has been impossible to draw sludge due to the fact that all the sludge was floating in the gas vents. At Washington the sizes of the units used in the design are well above the average, yet after the tank had been in operation for some time sludge belched up through the slot and it was thought that the sludge digestion chamber was filled to a level above the slot. An attempt was made to draw sludge through the regular sludge channels but only a black liquid discharged on the sludge bed. Upon examining the gas vents it was found that they were completely filled with a thin, viscous sludge with a heavy scum coating. Sewage was bailed from the settling compartment and discharged into the gas vents, which loosened the scum so that it could be agitated. In a few hours a little sludge could be drawn, but the next day the settled sludge again came to the top. After standing all winter it was found that all the scum had settled to the bottom.

The Imhoff tank treating the sewage of Princeton University caused considerable trouble for a number of years and it is only recently that it may be classed as a fairly satisfactory operating plant. During the last few years the tanks have not foamed over the gas vents, but there has been considerable belching in the settling compartment. Soundings indicated that the gas vents are filled with fine viscous sludge which is kept loose enough by continuous agitation to allow the gas to rise and escape. Below is

an analysis of sludge taken in 1917 as compared with analysis made in 1921.

Date	Reaction	Wet Sludge			Dry Material		
		% Water Content	% Dry material	% Fats	% Non Vol.	% Vol.	% Fats Odor
1917	Highly Alkaline	93.92	6.08	0.416	37.89	62.11	6.91 Musty
1921	Highly Alkaline	94.04	5.96	0.051	48.53	51.47	0.85 None

The most outstanding feature concerning this analysis is the reduction of the grease from 6.91 to less than 1 per cent. of the dry material. Grease traps have been perfected to collect grease from the mess halls of the University and this may be responsible for the improved operation of the plant.

The operation of the two-story tank at Plainfield is familiar to most engineers. Foaming has been common since the plant was installed in 1916. Every known method has been used by the operator, who is a technical man, to overcome this bad feature, but without any marked improvement. The operator claims that better results have been obtained since fine screens were installed to treat the raw sewage and the tanks alternated every fifteen days. Although foam does not overflow the gas vents as often as in the early days of operation, there still accumulates a mass of floating sludge of so slight a specific gravity that it will not settle. As this material increases in volume (there is no way of withdrawing it from the gas vents) it is carried up through the slots into the settling chamber, causing a very poor effluent.

The Oaklyn tank was placed in operation December, 1915. The tank worked very well up to 1921. There was no initial foaming period and the plant received very little care or supervision. Sludge drawn about every three months was good and the effluent was also satisfactory. The tank has a round sludge digestion chamber of 2,000 cu. ft. capacity and a longitudinal horizontal flow settling chamber. The gas vents are in the form of a segment.

In 1920 a new full-time operator began to remove sludge more frequently from the tank. From October, 1920 to May, 1921, he removed 1,250 cu. ft. of digested sludge, considerable more than the quantity of fresh sludge deposited during this period. A few days after the last sludge removal the tank began to foam violently. Some idea of the conditions as found by engineers from the State Department of Health can be obtained from the accompanying picture.

An investigation indicated that practically all the sludge had been withdrawn from the tank and that



FOAM OVERFLOWING GAS VENTS AT PLAINFIELD

\*Continued from page 62.

†Foaming in the Oaklyn tank was shown on the cover of the issue of Jan. 21.



the digestion chamber and gas vent were filled with foam and floating sludge. After standing twenty-four hours a small quantity of this foam was reduced to 10 per cent. of the original volume, indicating that sludge transformed into foam will expand at least ten times its original volume.

A number of treatments were tried under the direction of the engineers from the State Department of Health. Milk of lime, kerosene oil and water were applied at different times to the foam in the gas vents but without any appreciable results. A very fine water spray installed above the gas vents was very successful in breaking up the fine bubbles and prevented the foam from overflowing the walls of the vent but did not keep the foam from rising. As these conditions existed for some time it appeared that the incoming sewage did not contain those qualities which were necessary to build up a satisfactory sludge. In order to do this artificial means were finally employed. An endeavor was made to kill off the undesirable bacteria in the tank and substitute bacteria of better digestive qualities.

About ten pounds of hypochlorite (30 p. p. m.) were applied to the sludge and five pounds were added to the foam in the gas vents. Twenty-four hours later 15 cubic feet (.2 per cent. of the capacity of the sludge chamber) of good ripe sludge were obtained from the separate sludge digestion plant at Collingswood and discharged into the gas vents of the Oaklyn tank. It quickly sank, when paddled, to the bottom of the sludge digestion chamber. For two days the vents continued to foam but on the third day the foam began to subside, and on the fifth day foaming had entirely ceased. No foaming has occurred since this treatment.

An interesting example of what may happen if a satisfactory grit chamber is not installed for two-story tanks is seen at Fairview, where each year the

operator has to partly pump down the water in the Imhoff tanks and clean out the sand and grit. In the last six months over 20 cubic yards of grit were removed from one tank and 30 cubic yards from another. This condition has interfered with the operation of the plant.

It is extremely difficult to make a comparison between the operation of two installations, even when the unit sizes are the same. This is due to variations in the character of the raw sewage controlled somewhat by the character of the water supply. In the southern parts of New Jersey the water supplies are usually obtained from deep wells which contain considerable iron, and along the Atlantic coast there is high chlorine content in the water. Those municipalities using surface supply in the southern part of the state contribute through their water supply a highly colored water of low alkalinity or sometimes acid. Some of the well waters contain much carbon dioxide, others hydrogen sulphide. Not only does the quality of the well water affect the raw sewage but the percentage of solids is also an important factor. In some municipalities the water consumption is double and even triple that of others. Again, some municipalities have a much higher infiltration into the collecting system of sewers. It has been found that a dilute sewage is handled much better than a concentrated sewage, especially when starting the tank. It has often been tried and is considered advisable to dilute the sewage when first placing the tank in operation. This has been done by pumping brook water into the sewerage system during the first few months of operation.

An examination of the summary, "Operating Data of Imhoff Tanks in New Jersey," would indicate that a stale sewage is treated much better in an Imhoff tank than fresh sewage. As stated before,

#### OPERATING DATA OF IMHOFF TANKS IN NEW JERSEY.

	Actual Flow Gals. Per 24 Hrs.	Kind of Collec- tion System	Character of Raw Sewage	Reaction to Litmus	Sludge Distance Below Slot in Feet	Depth of Scum in Gas Vents in Ft.	Depth of Scum in Set- tling Com- partment	Settling Ef- ficiency Im- hoff Glasses	Frequency of Drawing Sludge	Labor Aver. Man-Hrs. Per Day
Bayhead .....	250,000	Pumps	Stale	Alkaline	3	4	T	90	6 mos.	2
Chatham-Madison .....	300,000	½ Pump	Fresh/Stale	"	2	4	T	95	3 "	2
Fairview .....	400,000	Gravity	Fresh	"	4	1	A	60	1 "	3
Glen Gardner .....	75,000	"	"	"	1	1	T	"	6 "	.15
(State Inst.)										
Hammonton .....	300,000	Pumps	Fresh/Stale	Alkaline	4	3	A	95	1 "	2
Kenilworth .....	100,000	Gravity	Fresh	"	"	"	"	"	"	1
Factory (Domestic)										
Lodi .....	500,000	"	"	"	N	O	A	98	"	2
Maywood .....	300,000	"	"	"	F	F	T	75	"	"
Moorestown .....	500,000	"	"	"	"	"	"	"	"	"
Oaklyn .....	100,000	Gravity	Fresh	Alkaline	N	2	T	90	6 mos.	1
Pitman										
No. 1 .....	300,000	"	Fresh/Stale	"	F	F	1	75	1 yr.	2
No. 2 .....	100,000	"	Fresh	"	F	F	1	85	"	1
Plainfield .....	3,400,000	½ Pump	Fresh/Stale	Alkaline	2	3	T	98	1 mo.	27
Princeton Univ. ....	300,000	Gravity	Fresh	"	2	3	T	80	1 yr.	.3
River Edge .....	60,000	"	"	"	F	5	.25	25	1 "	.3
Sea Side Park .....	30,000	"	Stale	"	3	4	T	80	1 "	.15
Skillman .....	300,000	"	Fresh	"	F	12	T	25	1 "	5
(State Inst.)										
Ventnor .....	700,000	Pumps	Stale	Alkaline	3	0	0	90	1 mo.	2
Washington .....	300,000	Gravity	"	"	A	5	0	95	6 "	2
Westfield .....	600,000	"	"	"	F	3	0	85	6 "	1

N=Normal. F=Completely sludged up. T=Trace. A=Absent.



the depth of the digestion chamber has very little effect upon the quality of the sludge, although the summary may indicate that the deeper the tank the better the sludge, but the increase in quality does not justify the increase in the cost of constructing deeper tanks. It is regretted that more definite instructions cannot be given as how to establish satisfactory bacterial action and prohibit foaming, but no single method or combination of methods has yet been found to work under different conditions. As stated before, the application of hypochlorite of lime followed by a ripe sludge inoculation was successful at Oaklyn, but will it be successful at all plants?

(To be concluded)

### Portland Cement Boycott Threatens Competing Mills

At the meeting of the Mississippi Valley Association of State Highway Officials in Chicago, Jan. 21, a resolution was signed by the chief executive highway officers of Illinois, Iowa, Kansas, Michigan, Minnesota, Missouri, South Dakota and Wisconsin, and was indorsed by representatives from Indiana and Ohio. It says, in part:

"Whereas it is practically inevitable that many millions of barrels of cement must be used annually in our programs, and,

"Whereas, manufacturers of cement have so far, in submitting prices for their product in 1922, entirely failed to measure the value of their industry to these large programs which have likewise entirely failed to measure the general decrease in commodity prices, in that no reduction was made in 1922 from the prices prevailing for the last four months of 1921, and the price named for 1922 is approximately only 10 per cent. lower than the price prevailing in January, 1921, which last price was likewise not in accord with the economic conditions prevailing,

"Resolved, by the executive officers of the highway departments of the states of Illinois, Iowa, Kansas, Michigan, Minnesota, Missouri, South Dakota and Wisconsin, assembled at Chicago at the fourteenth annual meeting of the Mississippi valley conference of state highway departments, that we pledge ourselves individually and collectively, as far as the power is reposed in us, not to make any contracts for highway construction involving the use of cement except the few contracts for work which cannot be possibly postponed until the manufacturers of cement have fixed the price of their product so that the road construction is not unduly penalized because of its magnitude, its urgency and its popular appeal, which price should be and must be in harmony with the reduced prices now in effect for all other basic commodities. Be it further

"Resolved, That we recommend that in those states in which laws and circumstances permit steps be taken immediately to investigate the possibility of erecting and operating cement mills to supply the construction needs of the state, since it appears that only in this manner can the cement industry be once more placed upon an open and competitive basis, and once more forced to follow general economic laws."

### 900 Railroads Sued for Lumber Rates Reductions

One of the most important and comprehensive freight rate suits brought by the lumber industry of the South, has just been filed with the Interstate Commerce Commission in Washington by the Southern Pine Association against all the railroads in the United States.

The Association asks for a general readjustment of freight rates on Southern pine lumber from the manufacturing territory to all destinations, and more than 900 railroads, comprising every line in the country, are named as defendants.

The petition alleges that the freight rates charged are excessive, unreasonable and unjust, discriminatory and prejudicial against Southern manufacturers and in favor of competing manufacturers. The Association also asks for simplification of freight schedules by the various railroads to be embraced in fewer tariffs.

Reductions in freight rates on Southern pine lumber equal to the reductions on hardwoods which were ordered by the Interstate Commerce Commission in its decision announced January 20, are expected to be made simultaneously with the hardwood decreases which are to be effective prior to March 6, next.

A. G. T. Moore, Traffic Manager of the Southern Pine Association, stated that at joint conferences held last December between Southern Pine Association representatives and officials of the Southwestern and Southeastern railroads, the carriers promised that the same reductions that were ordered by the Commission on hardwoods would be made voluntarily by the railroads on yellow pine shipments.

"The reductions just announced by the Interstate Commerce Commission on hardwoods," said Mr. Moore, "are not considered by us as sufficient to meet the commercial needs of the lumber industry in the South and are not enough to offset the greater reductions made in rates on lumber from the Pacific Coast to Chicago and points East."

### Two-Track Roads on Curves

In constructing concrete roads around sharp curves in San Diego County, California, R. M. Morton, engineer for the highway commission, has used a special type of construction which serves the double purpose of preventing head-on collisions and also excessive fill or cut because of the superelevation of the outside of the curve.

The road is 18 feet wide on tangents, but is made 24 feet on sharp curves, and sufficient superelevation would bring the outer edge of the road considerably higher than the inner edge if the cross-slope were continuous. But the road is divided into two roadways, each with its own superelevation, the inner edge of the outer road being about a foot lower than the outer edge of the inner road. This tends to keep each car on its own side of the road. However, the two roadways are connected by a roll or ogee curve, the concrete being continuous from one roadway across the ogee curve to the other roadway, preventing an accident should a car skid from one road to the other.

# Recent Legal Decisions

## **CITY TURNING WATER INTO CONSUMER'S MAIN CAN RECOVER FOR WATER ESCAPING THROUGH LEAK**

A city, at a consumer's request, turned water into a main belonging to the consumer, to provide fire protection under a contract that the consumer was to pay a turning charge and a fixed amount for all water used. It appeared that the water leaked after it passed through the meter, apparently at a hole in the joint between two pipes caused by the packing being removed, though the cause was not discovered until after the city had made a claim for water furnished. The Alabama Court of Appeals holds, *Anderson v. City of Montgomery*, 89 So. 857, that the city could recover from the consumer for the water which had escaped through the leak in the main, the consumer being liable for all water that passed through the meter.

## **STATUTE RELIEVING HIGHWAY CONTRACTORS FROM CONTRACT OBLIGATIONS BECAUSE OF WAR CONDITIONS HELD VOID**

The Indiana Supreme Court holds, *Davis Const. Co. v. Board of Com'rs. of Boone County*, 132 U. E. 629, that Indiana Acts 1919, c. 96, relieving highway contractors from their obligations under their contracts because of increased costs occasioned by the war, is unconstitutional.

## **ROAD SUPERINTENDENT ENTITLED TO SALARY EARNED**

The Alabama Court of Appeals holds, *State v. Stone*, 89 So. 823, that where, under Laws Sp. Sess. 1920, p. 148, no county road engineer was elected who accepted the office until January, 1921, until which time the court of county commissioners continued the road superintendent as its agent, the latter was entitled to payment of his warrant for salary for December, 1920.

## **MEASURE OF DAMAGES FOR RELOCATION OF MAINS CAUSED BY STATE'S APPROPRIATION OF STREET**

The State of New York, in constructing the Barge Canal, appropriated portions of a street in the City of Little Falls, necessitating the relocation of the city's water mains therein. The New York Appellate Division holds, *City of Little Falls v. State*, 190, N. Y. Supp. 807, that the proper measure of damages payable to the city is the fair and reasonable expense of the removal of the pipe line and its reconstruction elsewhere in the most economical way, and in the most available location. "The rights of the city to have its main in this particular street had no market value, except such as might rest in conjecture and speculation. In such unusual cases, it is necessary to abandon the stereotyped rules as to the measure of damages, which are not applicable, and take proof of damages in the best and most practicable and most reasonable way."

## **INTEREST COLLECTED ON DELINQUENT PAVING ASSESSMENTS BELONGS TO HOLDERS OF CERTIFICATES UNDER OKLAHOMA STATUTE**

The Circuit Court of Appeals, Eighth Circuit, holds, *Board of Comrs. of Pottawatomie County, Okla. v. Close Bros. & Co.*, 275 Fed. 608, that under

Comp. Laws Okla. 1909, §727, providing that delinquent paving assessments shall bear interest at the rate of 18 per cent., as construed by the Supreme Court of the State, the county has no interest in such delinquent assessments and that the 18 per cent. interest collected thereon is for the benefit of the holder of the paving certificates.

## **"ABUTTING ON THE IMPROVEMENT"—ENTIRE WIDTH OF STREET NEED NOT BE PAVED**

In proceedings to assess property for street improvements, the North Carolina Supreme Court holds, *Anderson v. Town of Albemack*, 109 S. E. 262, that the question of benefit is one of fact, and the governing board of a municipality under legislative authority is vested with the power to determine what lands will be benefited by the improvements, and their determination is conclusive upon the owner of the ground charged with the costs of the improvements, except in rare cases.

There are several methods of apportioning the costs of improvements, but there are two which are generally recognized—i. e., apportionment according to benefits and apportionment according to frontage—but the liability of the land to assessment is determined by the municipality under the authority of the legislature.

An objection that the owner's lot did not "abut on the improvement" because only 50 feet in the middle of the street was paved leaving a space of 22½ feet between the property and the paved portion of the street, was not sustained. It cannot be said that a street or sidewalk is not improved because it is not paved the entire width. By "abutting property" is meant that between which and the improvement there is no intervening land.

## **DRAINAGE DISTRICTS AS PUBLIC CORPORATIONS**

Drainage districts are public corporations or corporate subdivisions of the state, authorized to exercise the powers granted to them for the purpose of their creation, within their territorial jurisdiction, as fully and with like authority as municipal corporations exercise their powers. *State v. Albany Drainage Dist.* Missouri Supreme Court, 234 S. W. 339. *Arnold v. North County, Drainage Dist.*, (Mo. App.) 234 S. W. 349.

## **DRAINAGE CONTRACTORS HELD NOT ENTITLED TO DAMAGES FOR CARRYING OUT UNENFORCEABLE AGREEMENT**

At the time of making a drainage contract, the contractors orally agreed to begin excavation at a point not required by the written contract. The Wisconsin Supreme Court holds, *Schultz v. Three Lakes Drainage Dist.* 185 N. W. 190, that though the contractors were not originally bound by this oral agreement, when they did comply with it by setting up their dredge and beginning excavating as agreed, they could not afterwards, in an action for damages because of directions given them in the progress of the work, say that the agreement was not binding upon them, or that they were damaged thereby, even though the commissioners may have insisted upon them doing as they did.



#### RIGHTS OF WATER COMPANY TO SELL AND MUNICIPALITY TO PURCHASE PART OF COMPANY'S PLANT

In a suit to restrain a water company from selling part of its equipment to a municipality, on the theory that the water company would not be able in the future to supply the plaintiffs, the New York Appellate Division holds, *Town of Mamaroneck v. New York Interurban Water Co.*, 190 N. Y. Supp. 580, that there must be convincing proof, by a fair preponderance of evidence, that the proposed dismemberment of the plant will leave it destitute of the property, equipment and facilities, necessary for the performance of its duty to the plaintiffs, and that they will suffer irreparable damage thereby. It is also held that, under New York Stock Corporation Law, §16, as amended by laws 1920, c. 396, the water company has a right to sell its property, or any part of it, and that the city of Mt. Vernon has the right to purchase the company's property and engage in the business of purchasing water from the City of New York, and supplying and selling it without the consent of the Conservation Commission.

#### CROSS-TIES OF STREET RAILWAY PART OF TRACKS WITHIN PAVING ASSESSMENT STATUTE

The North Carolina Supreme Court holds, *City of Durham v. Durham Public Service Co.*, 109 S. E. 40, that under a statute defining the space to be assessed against a street railroad company for paving the roadbed as "the space between the tracks, the rails of the tracks, and eighteen inches in width outside of the tracks of such company," the cross-ties are included within the term "tracks."

#### ASSESSMENT OF RAILROAD PROPERTY FOR STREET IMPROVEMENTS

The South Carolina Supreme Court holds, *Atlanta & C. A. L. Ry. Co. v. City of Easley*, 109 S. E. 285, that railroad property abutting on a street is not exempt from street improvement assessments because the property is used for railroad purposes. "The public has a right to a street to get to the stations of the railroad, and it would be unjust and unfair to make other abutting owners of property pay and exempt the railroad \* \* \* if these streets are good, facilities for transportation will be good, and the business of the railroad will be benefited."

#### CITY CANNOT DELEGATE TO LANDOWNERS POWER TO DECIDE ON BUILDING PERMIT FOR BUSINESS BUILDING IN RESIDENTIAL DISTRICT

The New Jersey Supreme Court holds, *Levy v. Mravlag*, 115 Atl. 350, that an ordinance which provides that no permit shall be granted for the erection of any structure to be used for the sale, at retail or wholesale, of goods, which is intended to be erected within 500 feet in any direction along any street where three-fourths of the property is used or intended to be used for residence purposes, until there be filed with the municipal authorities written consent to the intended use by, those representing the owners of three-fourths of the property used or intended for use for resident purposes within the limit specified, is invalid because the municipality cannot lawfully delegate the power of regulation to a special body of contiguous landowners within a

limited district, for that power, if it exists in the municipal body, is legislative, and not administrative, and cannot be delegated. Such an ordinance cannot be justified upon the ground that it is necessary for public safety, and its only effect is to deprive the owner of his property or the use thereof without compensation, nor can it be justified upon the ground that it falls within the police power.

#### NOTICE OF DEFECT IN STREET AFTER REFILLING EXCAVATION

A city had made an excavation in a brick pavement to lay a water pipe connection and had refilled it temporarily so that the centre was 5 inches higher than the pavement. A few hours later the wheels of an automobile struck a depression in the filling about 12 inches deep in the centre, and ran into a trolley car. In an action for damages the New York Appellate Division holds *Jones v. City of Binghamton*, 198 App. Div. 183, 190 N. Y. Supp. 542, that the city was chargeable with knowledge of the condition in which it left the street surface. If the surface was left in a dangerous condition, the public should have been reasonably protected by lights or barriers or both. If it was left in reasonably safe condition for travel to be expected there and later, from some cause other than the unfinished condition in which it was left, a defect appeared, the city was entitled to notice of that defect before it could be held liable in negligence. If, on the other hand, the defect was due to ordinary travel, because of the unfinished and imperfect condition in which the city left the street surface—because its previous safe condition had not been restored—notice of the defect was not a condition precedent to a recovery by the plaintiff. Judgment of non-suit therefore reversed and a new trial granted. Two justices dissented, on the ground that the city could not be held liable, having had no actual or constructive notice of the defect, under Second Class Cities Law §244.

#### NINE MONTHS' DELAY IN ACTING ON ANNEXATION ORDINANCE HELD NOT UNREASONABLE

The Wisconsin Supreme Court holds, *Roehrborn, v. City of Ladysmith*, 185 N. W. 170, that, where a statute authorizing the annexation of territory by ordinance prescribes no time within which the ordinance must be acted upon, the council is required to act within a reasonable time. The court found no help from the authorities in deciding whether a delay of 9 months was unreasonable. A much shorter time is prescribed in many cases where local legislative and administrative bodies are required to act. It held that 9 months' delay though long was not so unreasonable as to make the action of the council void.

#### IMMATERIAL CHANGE IN PLANS OF ROAD IMPROVEMENT

The Arkansas Supreme Court Holds, *Carson v. Road Improvement Dist. No. 2*, 234 S. W., 257, that the commissioners of a road improvement district, duly authorized to construct an improvement; may make immaterial changes in their approved plans and specifications after the required submission of such changes to the county court, and that a change in the method of surfacing the road, adding only 4 per cent to the cost, is an immaterial change.

## NEWS OF THE SOCIETIES

### CALENDAR

**Feb. 4-11—ST. PAUL BUILDING EXCHANGE EXPOSITION.** St. Paul, Minn.

**Feb. 7—ASSOCIATED MANUFACTURERS OF WATER PURIFYING EQUIPMENT.** Annual meeting. Bellevue-Stratford Hotel, Philadelphia, Pa. Secretary—H. G. Tate, 105 W. Monroe street, Chicago, Ill.

**Feb. 8-9—NORTH DAKOTA SOCIETY OF ENGINEERS.** Fourteenth annual meeting. Jamestown, N. D. Secretary—E. F. Chandler, University of North Dakota.

**Feb. 8-10—MICHIGAN ENGINEERING SOCIETY.** Annual meeting. Kalamazoo.

**Feb. 12-17—CONFERENCE OF HIGHWAY ENGINEERING,** 8th annual conference. University of Michigan, Ann Arbor, Mich.

**Feb. 13-16—AMERICAN CONCRETE INSTITUTE.** Annual Convention, Cleveland. Secretary, Harvey Whipple, 814 New Telegraph Bldg., Detroit, Mich.

**Feb. 14—ENGINEERING SOCIETY OF BUFFALO.** Iroquois Hotel, Buffalo. Secretary—N. L. Nussbaumer, 80 W. Genesee St., Buffalo.

**Feb. 15-17—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.** Tenth midwinter convention. Engineering Societies' Bldg., New York City.

**Feb. 20-23—NATIONAL ASSOCIATION OF BUILDERS' EXCHANGES.** Annual meeting. Hotel Chisca, Memphis, Tenn.

**Feb. 21-22—KENTUCKY ASSOCIATION OF HIGHWAY CONTRACTORS.** Annual meeting. Louisville. Secretary, D. R. Lyman, 523 Court Place, Louisville, Ky.

**Feb. 21-23—MINNESOTA FEDERATION OF ARCHITECTS AND THE MINNESOTA SOCIETY OF CIVIL ENGINEERS.** First annual convention, Curtis Hotel, Minneapolis.

**Feb. 22—AMERICAN ASSOCIATION OF ENGINEERS.** Conference of practicing engineers. Congress Hotel, Chicago.

**Feb. 22—AMERICAN BUILDING EXPOSITION.** Municipal Auditorium, Cleveland, Ohio.

**Feb. 24-25—ENGINEERING SOCIETY OF WISCONSIN.** Annual meeting. Madison. Secretary—L. E. Smith, Madison.

**Mar. 14-16—AMERICAN RAILWAY ENGINEERING ASSOCIATION.** Annual convention. Chicago, Ill.

**Apr. 19-21—TRI-STATE WATER AND LIGHT ASSOCIATION OF THE CAROLINAS AND GEORGIA.** Spartanburg, S. C.

**Apr. 27-30—BUILDING OFFICIALS' CONFERENCE.** Apr. 27-28, Cleveland, O.; Apr. 29, Massillon, O.; April. 30, Youngstown, O.

**May 15-19—AMERICAN WATERWORKS ASSOCIATION.** Annual convention. Philadelphia, Pa.

**June 4-6—AMERICAN ASSOCIATION OF ENGINEERS.** 8th Annual Convention. Salt Lake City, Utah.

### PRACTICING ENGINEERS' MEETING

The American Association of Engineers will hold a conference of practicing engineers at the Congress Hotel in Chicago on Wednesday, February 22, Washington's Birthday.

The tentative program includes the following subjects:

How to sell engineering service.

Experience of the practical engineer with licensing.

(a) State reciprocity.

(b) Licensing of engineering corporations.

Publicity for practicing engineers.

Cost accounting for engineering service.

Bookkeeping for an engineering office.

How to uphold the standards of services and fees.

Amendment of schedules of services and fees.

(a) Providing for other branches, such as mining and mechanical.

(b) To fit to the practice appertaining to the several parts of the country.

Computing the practicing engineer's income tax.

The conference will be in charge of the Committee on Services and Fees of Practicing Engineers of the Association. An invitation to attend the conference is extended to all practicing engineers, whether members of the Association or not, who are interested in the subjects on the program.

### NATIONAL FEDERATION OF CONSTRUCTION INDUSTRIES

At its January 19th conference in Philadelphia, the Federation took up the question of "Recruiting and training apprentices, journeymen and workers in the building trades" as the most important problem before the construction industry today. The Board of Education, Builders Exchange, Union representatives and Industrial Relations Committee of the Chamber of Commerce discussed its various phases.

### MINNESOTA SURVEYORS' AND ENGINEERS' SOCIETY

The twenty-seventh annual convention will be held February 21, 22 and 23 with headquarters at Curtis Hotel, Minneapolis, Minn.

February 21 (Forenoon), Business Meeting—The afternoon program supplied by the Minnesota Federation of Architectural and Engineering Societies, includes Building Stone of Minnesota, John H. Mullen, Geo. M. Shepard, Edwin H. Hewitt; The Architects Small House Service Bureau, Edwin H. Brown; Sewage Disposal in Minnesota, J. A. Childs.

February 22 (Forenoon)—Federation Program, Surveyors and Engineers Society Adjourned; Peat as a Fuel, Max Toltz, H. J. Meyers, F. A. Wildes; The Minnesota Registration Law for Architects, Engineers and Land Surveyors, Paul Doty; Research Work at the University of Minnesota, Dean O. M. Leland; Building Ordinances of the State, Edwin H. Brown, F. G. German, P. E. Stevens.

Afternoon Sectional Meetings—Highway, C. L. Motl, presiding; Municipal, E. H. Curtis, presiding; Drainage, H. B. Roe, presiding.

Evening—The banquet will be held jointly with the Minnesota Federation.

February 23 (Forenoon)—Sectional

meetings will be continued as on the previous afternoon.

Afternoon—Report of the nominating committee.

Report of the resolutions committee.

### ENGINEERING SOCIETY OF AKRON

The Engineering Society of Akron, Ohio, mechanical section, held a joint meeting with the local section of the American Society of Mechanical Engineers in December. The meeting was addressed by Dexter S. Kimball, dean of Engineering College, Cornell University; and president-elect of the American Society of Mechanical Engineers, on "Various Phases of Engineering Society Activity."

### NEW ENGLAND WATER WORKS ASSOCIATION

The annual meeting of this Association was held, as required by the Constitution, at the rooms of the Association, Tremont Temple, on Wednesday, January 11, 1922, at 2 p. m.

No arrangement had been made to provide a program for this date, and it was not expected that a quorum would be present. The meeting was adjourned to Thursday, January 12, 1922, at 1 p. m., at which time the adjourned meeting was opened in the Banquet Room on the ninth floor of the Boston City Club, Somerset street and Ashburton Place, Boston. At this time the regular program was carried through as follows:

11.00 a. m. Meeting of Executive Committee at Headquarters, Tremont Temple. 1.00 p. m. Luncheon was served at the Boston City Club. 2.00 p. m. Business of the Annual Meeting; Report of Tellers of Election; President's address, "Some observations on Water Consumption." Paper—"The Design and Construction of the Gloverville Standpipe." by Frank A. Marston of Metcalf & Eddy, Consulting Engineers, Boston, Mass.

### AMERICAN SOCIETY OF CIVIL ENGINEERS

The monthly business meeting of January 4 was followed by a four session conference on "The National Housing Problem." "Broad Economic Phases," Lawrence Veiler, Lawson Purdy, John M. Gries, and John J. Murphy.

January 5th, "Planning and Zoning, etc.," Joseph C. Wagner, B. Antrim-Haldeman, Charles M. Reppert, Charles W. Leavitt (illustrated), and Andrew J. Thomas. "Utilities," E. P. Goodrich, H. M. Pirnie, W. L. Stevenson, and F. G. Hibben (illustrated). "Legislation and Finance," Edward M. Bassett, Arthur C. Comey, Allan Robinson, John Ihlder, and William H. Ham.

The Central Ohio section of the A. S. C. E. elected as president W. F. Jennings and as secretary H. F. Schryver; and the Northeastern section has elected the following officers: chairman, Frank B. Sanborn; vice-chairman, Walter C. Voss; secretary-treasurer, Charles W.



Banks; and members of the executive committee, Leonard C. Wason and James H. Manning. The New York section at its meeting on January 11th considered the topic, "Traffic Handling—Its Engineering as Well as Regulatory Aspects." Addresses were by E. P. Goodrich and Amos Schaeffer.

#### AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Several interesting section meetings of the A. S. M. E. were held recently. These included the joint meeting of the Atlanta section with the Affiliated Technical Societies of Atlanta, on January 24; the joint meeting of the Boston section with the American Institute of Electrical Engineers and the American Society of Heating and Ventilating Engineers on the same date, at which was discussed "The Great Lakes-St. Lawrence Tidewater Project;" addresses by W. L. Saunders on "Commercial and Transportation Features of the Project," and Henry deB. Parsons on "Hydro-Electric and Civil Engineering Phases of the Project;" the meeting of the Bridgeport branch on January 26, at which Edmund S. Wolff spoke on "Finance and Engineering;" and the meeting of the Detroit section on the 27, at which Major Theodore A. Leisen, of the Detroit water works department, discussed the "City of Detroit Filtration Plant."

The New Britain branch met on January 31, when it was addressed by Pro. L. P. Breckenridge, of the Sheffield Scientific School, Yale, on "The Importance of the Super-Power System to New England."

The Providence Engineering Society, affiliating with the Providence section, A. S. M. E., American Chemical Society, American Institute of Electrical Engineers, American Society of Civil Engineers and American Society for Steel Treating held its sixth annual banquet on January 31 at the Narragansett Hotel. Floyd W. Parsons addressed the meeting on "The Engineer in Public Service," and Daniel A. Mackay discussed "Public Service in the Northwest."

#### SEATTLE ENGINEERS' CLUB

The Seattle Engineers' Club recently elected the following officers to serve during 1922: President, Stuart Mannel; Vice President, Chester F. Lee; Secretary, Lyman T. Banks; Treasurer, Amos Stater, and members of the Executive Board, J. Thomas Dovey, Ralph S. Drury and J. F. Pinson.

#### INDIANA ENGINEERING SOCIETY

The Indiana Engineering Society held its annual meeting at Purdue University, Lafayette, Ind., on January 19 and 20. Among the subjects discussed were the following: "The Future of the Gas and Steam Automobile," Prof. A. C. Staly, Purdue University; "Sphere of Influence of the Society," R. C. Geoman, Indianapolis; "The Engineers' License Law," Prof. R. L. McCormick; "Current Issues

for the Engineer," H. O. Garman, Indianapolis; "Sanitary Engineering," Paul Hansen, Chicago; "The Indianapolis Sewage Plant," C. K. Calvert; "The Engineer in Politics," by John Elliott, city engineer, Indianapolis.

#### GREAT FALLS ENGINEERING SOCIETY

The Great Falls Engineering Society has recently been organized at Great Falls, Mont., with forty charter members. The officers are: President, E. T. Harlow, and Secretary-Treasurer, John S. Roth.

#### SOCIETY OF INDUSTRIAL ENGINEERS

The Society of Industrial Engineers has elected Joseph W. Roe as president; W. G. Sheehan, of Detroit, secretary, and F. C. Schwedtmann, New York, treasurer.

#### PENNSYLVANIA HIGHWAY CONTRACTORS

Over 100 representatives of firms interested in the State highway contracts attended the second annual meeting of the Association of Pennsylvania Highway Contractors, in Harrisburg, Dec. 16, and heard addresses upon construction methods, supplies and other matters connected with road building. The afternoon session was devoted to discussion of mechanical devices for road construction.

The speakers generally looked for construction on a large scale next year and for much improvement work. Officers elected were:

William D. Hill, Carnegie, president; S. M. Irwin, Philadelphia, vice-president; Lea Hunt, Wilkes-Barre, treasurer; H. H. Wilson, Muncy, and Walter S. Rae, Pittsburg, were elected to the board of governors for one year and E. R. Shenk, Erie; Henry F. Baton, Philadelphia; B. G. Coon, Luzerne, and J. C. Devine, Alliance, Ohio, were chosen vice-presidents.

#### NEW YORK HIGHWAY COMMISSION CONFERENCE

Superintendents from 57 counties in New York met January 18 for a two-days' conference at the State Commissioner's office, Albany, and discussed various subjects under the chairmanship of William B. Reed, Third Deputy Highway Commissioner. Among the principal subjects there were building and maintenance of farm and market roads, care of earth roads, bridge design and construction, and road maintenance.

Senator Lowman said the people of the state are friendly to taxation for building and maintaining roads and members of the legislature look with favor upon requests for appropriations for extending the highway system. Deputy Commissioner Reed reported that, during the last year, under the Lowman act, 1,100 miles of hard surfaced roads in the rural districts were improved. Earth roads on Long Island were reported to be exceptionally good and were given a rating of 100 per cent. Conditions found in other parts of the state made an average of 65 per cent.

He urged county officials to give more attention to the care of earth roads, suggesting that towns purchase an up-to-date equipment, consisting of tractor and a three wheel hone.

#### PERSONALS

Bingham, Clarence A., formerly city manager of Norwood and Waltham, Mass., and Watertown, N. Y., has been chosen city manager of Lima, Ohio.

Windrow, Rollen J., state highway engineer of Texas for the past three years has resigned.

Stanton, Col. Charles E., U. S. A., retired, has been appointed commissioner of public works of San Francisco, Cal.

Mather, Thomas H., has been appointed city engineer of Syracuse to succeed Henry Allen.

Diehl, Thomas R. has been chosen city manager of Westerville, Ohio.

Schmidt, William A., of Johnstown, Pa., has been appointed street commissioner to fill the vacancy by the death of John Kammer.

Stacy, George A., superintendent of the Marlboro, Mass., water and sewer department and former president of the New England Water Works Association, died at his home in Marlboro on December 22nd.

Marsh, John R. has been appointed a member of the Muncie, Ind., board of public works.

Hughes, Earl O., has been appointed director of public service of Van Wert, Ohio, and Patrick O'Mara has been made superintendent of streets.

Hodgson, F. R., of Joplin, Mo., has been appointed assistant engineer to S. Ashcraft, city engineer of Joplin.

Speer, Ray, county engineer of Keeweenaw county, Mich., has resigned to accept a position with the Wisconsin state highway department.

Layton, W. A., has been appointed city manager of Salina, Kansas.

Pharr, Leroy, has been appointed city manager of Eastman, Ga.

Saddler, C. Webb, has been appointed city manager of Sandusky, Ohio.

Magley, Frank, has been appointed drainage commissioner of Whitley county, Ind.

Brown, Norman E., has resigned as director of public works of Pittsburgh, Pa., to become vice-president of the Dravo Contracting Co. of Pittsburgh.

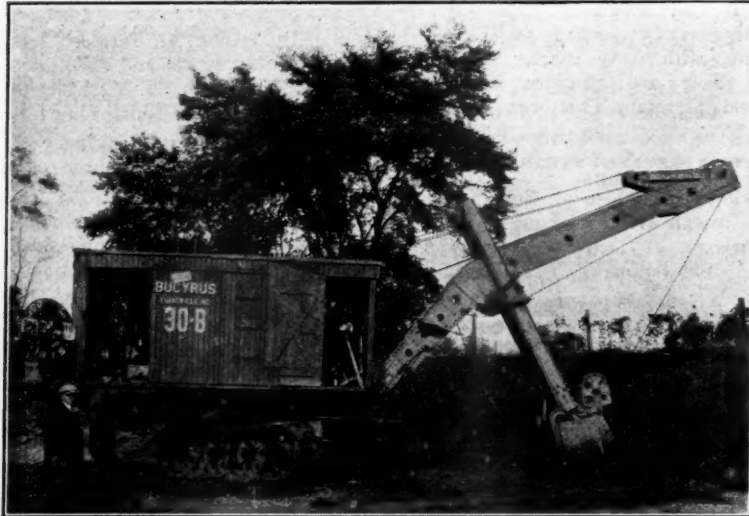
Wills, E. Harold, Mount Holly, N. J., has been appointed county engineer to succeed James Logan who resigned.

Bradshaw, H. J., present city engineer of Stamford, Tex., will assume the duties of city manager to succeed Homer D. Wade who has resigned.

Ackerman, J. Walter, formerly city engineer of Auburn, N. Y., has been appointed city manager of Watertown, N. Y., succeeding C. A. Bingham, resigned.

# New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



**GASOLINE OPERATED SHOVEL WITH QUICK REVERSAL AND POWERFUL THRUST**

## A NEW GASOLINE REVOLVING SHOVEL

A gasoline operated shovel with no engines, motors, shafts, chains or gears on the boom and yet with an actual digging power greater than a steam shovel of the same size is a new development in the manufacture of excavating machinery that has recently been announced by the Bucyrus Company.

This machine, known as the Bucyrus 30-B gasoline shovel, overcomes the serious difficulties of efficient transmission of power to the thrust without excessive complications in design, and the obtaining of digging power commensurate with that of a steam machine of similar size. The manufacturers have also succeeded in obtaining in this new machine the digging characteristics of the steam shovel with its quick reversals, its powerful thrust of the dipper and its dependability.

Before being put on the market, this shovel was successfully used for a period of six months for overcasting and loading dump cars in sticky clay, for grading for a concrete road where the cut averaged 5 inches in old macadam, and for stripping a stone quarry and loading trucks in a stiff hardpan containing many boulders.

It is far simpler than a steam, electric or other types of gasoline shovels and has fewer parts to maintain and keep in order.

Its digging power is even greater

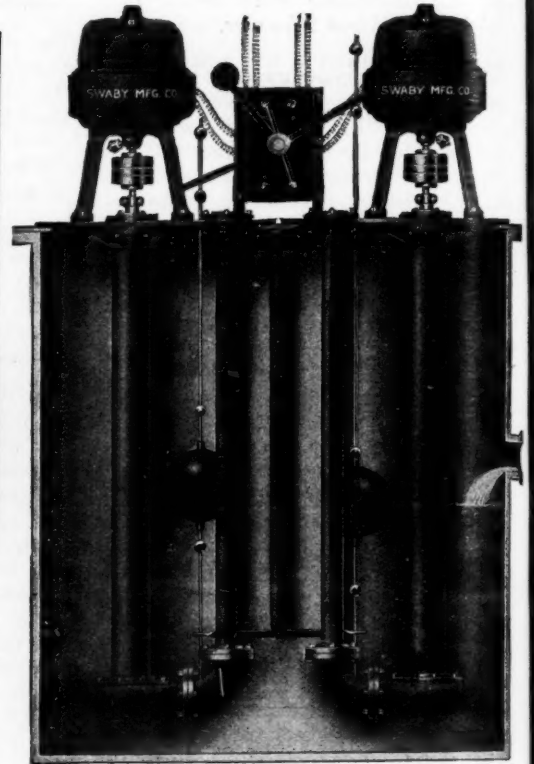
than a steam shovel of the same size.

It has all the well-known performance characteristics of a steam shovel, even to the snaking of the dipper to relieve it of sticky material.

It will give 20 per cent greater yardage per gallon of gasoline than an electric shovel of the same size, or than any other type of shovel whose power is derived from a gasoline engine. This is due to less mechanical loss and less waste energy.

The gasoline engine with which this shovel is equipped is over twice as heavy and rugged as the type of commercial gasoline engine sold for this purpose. It was designed especially for this shovel from specifications offered by the Bucyrus engineers and consequently it is suited for the exacting requirements of this unusually severe service. It is entirely inclosed and thus dust proof, a feature of much importance for excavating work. The engine is a four cylinder, slow speed type and will develop 55 h.p. at a speed of 40 r. p. m.

The shovel carries a 1-yard dipper and may be equipped as a dragline excavator, a crane or a clamshell machine with simple changes which may be made in the field. It fills a long-felt want, for those whose work is in arid regions or where coal is scarce and expensive and feed water of poor character.



**DUPLEX BILGE PUMP MOUNTED ON CATCH BASIN**

## DUPLEX ELECTRICAL CENTRIFUGAL BILGE PUMP

Among the numerous pumps listed by the Swaby Mfg., Co. in the 9th edition of their 1921 catalog of Modern Centrifugal Pumping Machinery there is a duplex electrical centrifugal bilge pump made in three sizes of 60 to 400 gallons per minute capacity for a pit 5 feet deep and 5 feet in diameter and in one size of 300 gallons capacity for a pit 5 feet deep and 6 feet in diameter. Special sizes are built on order with capacity to fit any conditions or any amount of liquid, size of pit, height of delivery, voltage and kind of electric current.

The pumps are entirely automatic in action with floats so arranged that one pump starts operating and if unable to care for the inflow is supplemented by the starting of the second pump, and it operates until the level of the liquid in the catch basin lowers, when the second unit stops automatically and the first unit continues pumping until the basin is empty when it also automatically stops. Thus, for light service, one pump is held in reserve, and for heavy duty both pumps are utilized.